HEFFRON PARK SWIMMING CENTRE, MAROUBRA NSW

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INDUSTRIAL GALVANIZERS

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Introduction

After 22 years service in hot, humid conditions the galvanized steel structure that is the enclosure for Heffron Park Swimming Pool is still providing protection against corrosion.

Fabricated and erected by Barrett Bros. of Fairfield in 1976, the pool has been in use 365 days a year ever since. A heated pool, the humidity is high at around 75%. The internal temperature rises and falls with the prevailing external climatic conditions.

During the service life of the structure, the steel has never been overcoated or treated in any way and still has a zinc coating of over 90 microns.

The complex is owned by Randwick Municipal Council and leased and operated by swimming coaches Tony Buck and Jim Gollan, accommodating squad training and school classes from 5 a.m. until late evening.

Location: Maroubra NSW

Located in Sydney's South East suburb of Maroubra, the complex is approximately 2 km from the sea front. To one side is a sports field complex to the other is a residential area. There are no Industrial plants in the immediate vicinity.

Building Description

Fabricated and erected predominantly out of 310UB46, the building is 33m x 18.5m x 3.8m high. The walls are completed in standard brickwork and the roof clad in corrugated UV resistant Perspex type material. The roof sheeting was chosen to allow natural light into the pool area and minimise the use of electric lighting. The floor surface surrounding the 25m pool is uncoated cement.

Test Procedure

A non-destructive test procedure using an elcometer, which gives a mean thickness reading of two points in contact was used. At selected test areas, a minimum of 10 readings was taken and the average readings published herein. (As 1650 Clause 5.2-1 P.10).

Test areas were selected at random on both vertical beams and roof structure, on galvanized coatings only. All tested steelwork is original ie. fabricated and coated in 1976.

Coating mass is recorded in micrometers (μm) and grams/m².

All conversions and test procedures carried out in accordance with AS1650/1989.

Discussion

The galvanized steel is still in excellent condition 22 year's after service. Upright columns demonstrated a build up of carbonate layers, which at first sight appeared to be a salty or sandy covering up to approximately shoulder level. This area is typically a splash zone from swimmers entering the pool or walking past while wet. Over this rough appearance was a glazed finish. The thickness readings in these areas range from 150μm to 160μm.
Carbonates form as a function of the environment and of the constituents that are in the atmosphere. They have been shown to reduce the rate of corrosion (Xiaoge et al) as they inhibit the atmospheric effect on the surface of the zinc. Active in this humid environment is chloride, which may tend to increase corrosion. Again this effect is usually overcome by the carbonates that form films of relatively low solubility, in close contact with the zinc surface. (ILZRO, New York, 1986).

Further, atmospheric variables of air temperature and humidity also determine the corrosivety of the local environment, the influence of these factors on the corrosion of zinc is related to their effect on the initiation and growth of protective carbonate films. (ILZRO etal P10). The moisture content in the air expedites the rate at which these protective carbonate films develop, according to Anderson and Fuller. In our sample, the water condensation remains in contact with the steel at high humidities. These films are allowed to form and grow in this indoor environment due to the lack of any type of precipitation, which may act to wash away corrosion products. Poor ventilation inhibits evaporation of the condensation. The rate of corrosion of zinc below this protective film is considerably less than other areas of the sample, that have not been subject to splashing and friction by passes by, which increase the rate of growth of the carbonate film. These other areas have formed protective carbonate layers, but due to the location of the steel, is much thinner. As noted earlier, the physical characteristics of the condensation affect the corrosion rate. Thickness readings on the zinc in these areas were in the region 90μm to 100μm, some 50μm lower than in high traffic areas.

This is quite clearly an environment where corrosion can occur as suggested by Anderson & Fuller, however, the galvanized coating has stood up remarkably well to these conditions and has in fact been enhanced by the growth of carbonate films over the zinc.

Results

After 22 years exposure to this typical indoor swimming pool environment, the galvanized coating has performed exceptionally well.

All coating thickness readings exceeded 80μm, the highest reading being 112μm, where thick carbonate films did not exist. The current Australian Standard AS1650/1989 calls for a minimum coating thickness of 84μm on this type of steel.

It is fair to say that because of the protective films that have formed over the zinc, the rate of corrosion has slowed. However, using the following assumptions we can determine an approximate rate of corrosion.

Coating thickness is determined by the thickness of the steel and its chemical composition.

Steel used for this project was locally manufactured by BHP, while test certificates are not available for this steel, we have been advised by BHP that steel chemistry at that time would be comparable of that used today.

The galvanizing process has been unchanged since the original steel was coated.

Similar steel members galvanized at Industrial Galvanizers (Sydney) Wednesday, December 16th recorded coating thickness of 200-220μm.

Thus we can calculate the galvanized coating over 22 years to be approximately 110μm or 5μm per year. Based on this we can predict that the coating would provide in the order of another 15 years of protection.

With the data gathered during this site inspection, we will be able to prove the theory of enhanced protection with a further site inspection in the future.

Conclusion

In this hot humid atmosphere, hot dip galvanizing has provided 22 years maintenance free life. At the time of specification, Randwick Municipal Council Engineers required a virtually maintenance free coating. This has been achieved comfortably, without causing any disruption to the pool service.

Similar pools with painted steel in Toongabbie and Emu Plains (NSW) have required re-painting every 3 years, significantly increasing the overall life cost of the structure. (Zinc Today, Feb. 1976, P5).

This structure proves conclusively that Hot Dip Galvanizing performs exceptionally well in indoor heated swimming pool structures and provides extensive cost benefits over the life of the structure.

Where cost benefits, extended maintenance free life and superior corrosion protection are required, hot dip galvanizing is clearly a superior surface treatment.

REFERENCES

AS 1650/1989. Hot dipped Galvanized coatings on ferrous articles. Standards Australia

AS2312/1980. Guide to the protection of Iron & Steel against exterior atmosphere corrosion.

Galvanizers Association of Australia 1995. Hot Dip Galvanizing. Fourteenth Edition

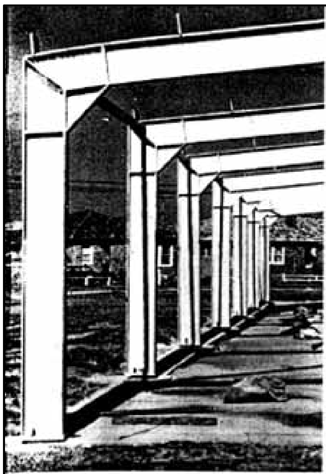
Corrosion & Electrochemistry of Zinc. Xiaoge Gregoery Zhang, Plenum Publishing, New York,1996.

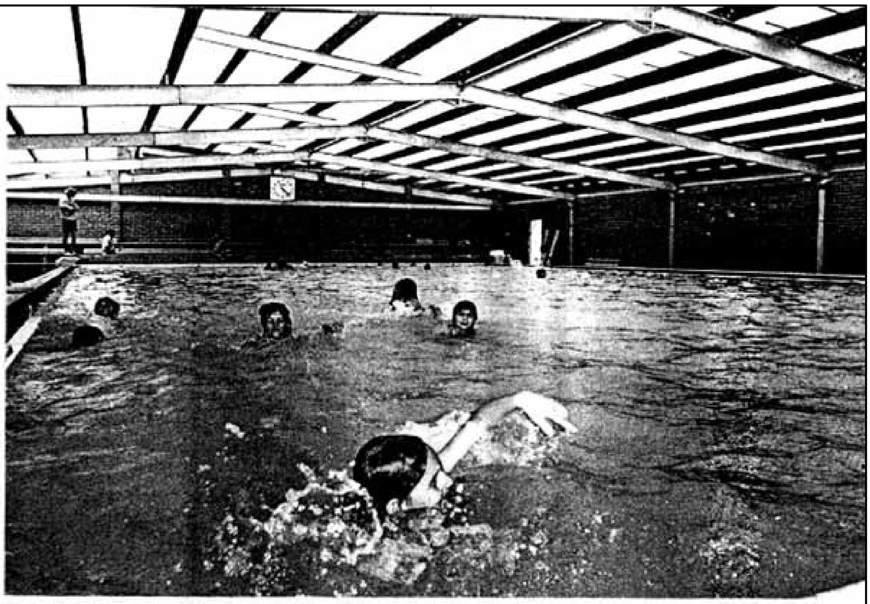
Zinc Based Steel Coating Systems: Metallurgy and Performance. George Krauss, David K. Matlock. TMS Publications, Pennsylvania, USA 1990.

APPENDIX

1. Zinc Today page 5, February 1976
2. Zinc Today page 15, September 1990

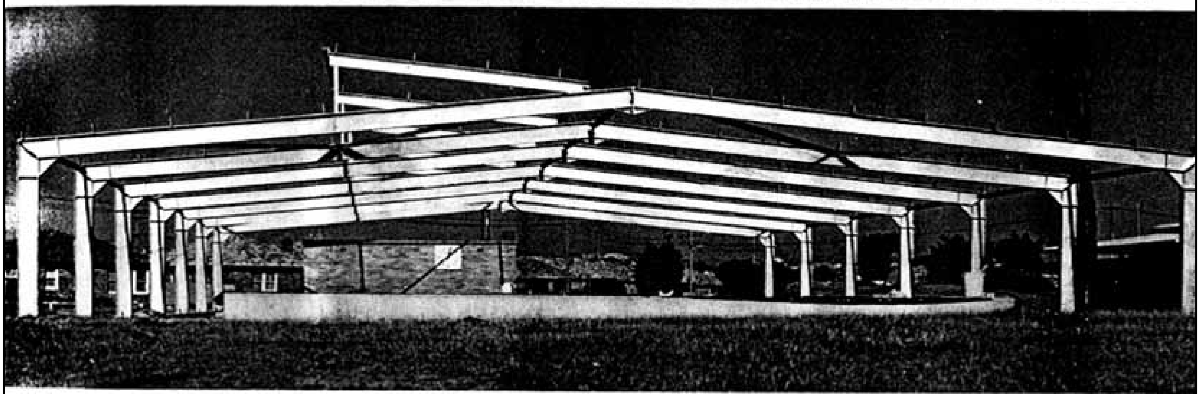
Appendix 1





Right: Action in the completely covered, 25 metre long pool at Heffron Park. Portal frames are fully hot dip galvanized.

Below: The all galvanized steel me enclosing the pool with a close- of frame members (above) during construction.



All-weather protection for Heffron Park Pool

At 4 am on a winter's morning when the temperature is around 4°C, it's a hardy youngster who will brave the elements to swim several miles for a training session.

Although the 25-metre pool at Heffron Park, at Maroubra, is heated, for the past several years the pool has been unsheltered and open to all sorts of weather.

Barry and John Rogers, well-known Australian swimming and surfing champions, have been coaching and training budding young Australian swimmers, all year round, since the pool was built in 1971. Their efforts have produced talented youngsters like Max Metsker, who represented Australia at the World Swimming Championships at Cali, Columbia, last year.

Now the Randwick Municipal Council, which administers Heffron Park, has decided to enclose the pool and the structural steel frame of the building was zinc protected with hot dip galvanizing.

The building which will enclose all of the pool area is 33 metres long by 18.5 metres wide and 3.8 metres high. It consists of 7 pin based portal frames, bolted at the ridge. Each frame is constructed from 310 UB 46 universal beams measuring 305 mm x 165 mm with an average thickness of approximately 9.6 mm.

These frames, because of their length (approx. 10 metres x 3 metres), presented a complicated task to Galvanising Services Pty. Ltd., at Yagoona, who had to triple dip each section to completely hot dip galvanize all of the steel frame.

Randwick Council engineers specified hot dip galvanizing for protection of the steel frame against the corrosive, humid chlorine environment. They wanted an aesthetically pleasing coating that required virtually no maintenance, thereby minimising the need to take the pool out of service and interrupt critical training schedules.

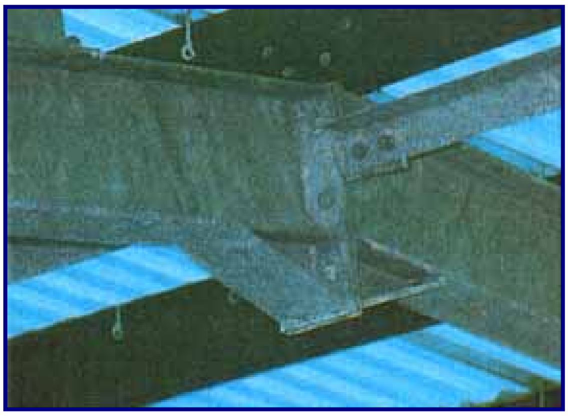
As well as providing pleasing appearance and superior corrosion protection, hot dip galvanizing was found to be one of the cheapest coatings to apply and, because of its inherent toughness, the galvanized coating suffered no damage during erection.

Other pools, such as the Alex Bory heated pools, at Toongabbie, had used high-performance paints but under these severe conditions peeled in 3 months and required complete recoating within 3 years. Subsequent enclosures built by Alex Bory, at Emu Plains, have used hot dip galvanized frames and showed no sign of rust or deterioration after nearly two years' operation.

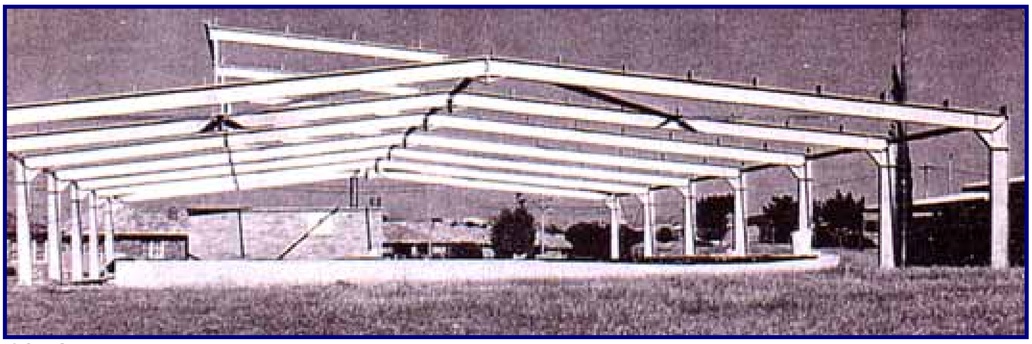
The fabrication and erection of the frame for the Heffron Park Pool was carried out by Barrett Bros. Pty. Ltd., of Fairfield.

Appendix 2

Location:	Heffron Park Swimming Pool Enclosure in Sydney, New South Wales.
Age:	14 years
Environment:	Warm, humid
Current zinc Coating:	80 – 120 μm
Reference:	*Zinc Today* 24, Feb 1976.



1990



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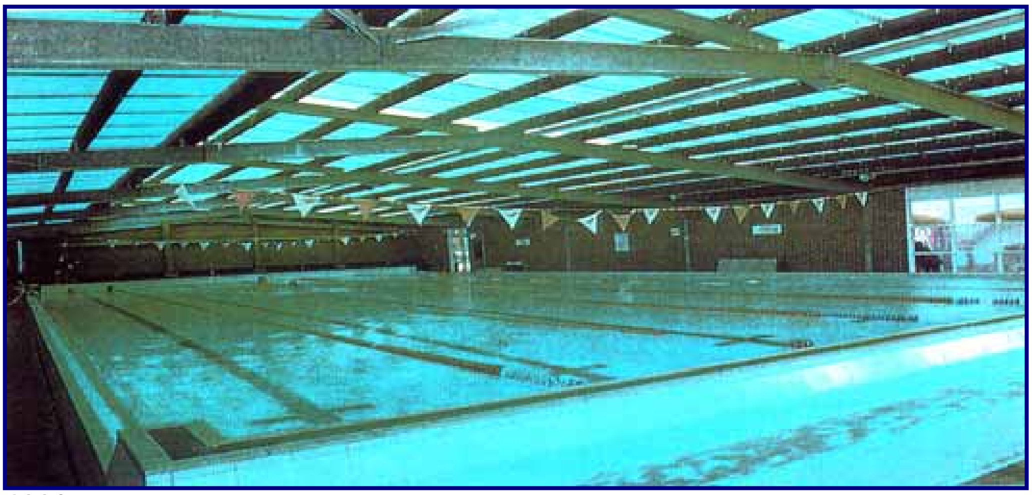

1990

Comments: The 25 metre pool was built in 1971 and enclosed in a 33m x 18.5m x 3.8m high structure in 1975. The seven portal frames which support the building were all hot dip galvanized and the coating is still in good condition, measuring 100-120*um*, despite the humid chlorine environment.

Engineers from the Randwick Municipal Council specified hot dip galvanizing for protection of the steel as it was one of the cheapest coatings to apply, as well as requiring virtually no maintenance, thereby minimising the need to take the pool out of service and interrupt critical training schedules.

It can be expected that the zinc coating will provide at least a further 15 years protection.